PROGRAMMING AND
IMPLEMENTATION
DOCUMENTATION

FEASIBILITY STUDY FOR INSTALLATION OF UMCS FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

Prepared for

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
KANSAS CITY, MISSOURI

Under

U.S. ARMY ENGINEER DISTRICT, MOBILE
INDEFINITE DELIVERY A-E CONTRACT
CONTRACT NO. DACA01-94-D-0033
DELIVERY ORDER NO. 0001

EMC ENGINEERS, INC.

DENVER, COLORADO
ATLANTA, GEORGIA

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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PROGRAMMING AND IMPLEMENTATION DOCUMENTATION

FEASIBILITY STUDY FOR INSTALLATION OF UMCS
FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

Prepared for

U.S. Army Corps of Engineers
Kansas City District
Kansas City, Missouri

Under

U.S. Army Engineer District, Mobile
Indefinite Delivery A-E Contract
Contract No. DACA01-94-D-0033
Delivery Order 0001
EMC No. 1406-001

December 1995

By

E M C Engineers, Inc.
2750 S. Wadsworth, Suite C-200
Denver, Colorado 80227
303/988-2951

1. COMPONENT **ARMY**	FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE **DEC 1995**
3. INSTALLATION AND LOCATION **Fort Riley, Kansas**		4. PROJECT TITLE **Install Basewide Utility Monitoring Control System (UMCS)**		
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NO.	8. PROJECT COST ($000) **5,840**	

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Primary Facilities: Provide a UMCS to include 190 buildings. Provide PC-based front-end computers, Central Operator Station, Communication Processor, Remote Control Units, Auxiliary Control Units, Unitary Control Units, sensors, and actuators. Provide fiber optic data transmission to the 190 buildings on the UMCS.	LS			4,698
Estimated Contract Cost				4,698
Contingency (10%)				470
Subtotal				5,168
Supervision, Inspection and Overhead (7.0%)				362
Design Cost (6.0%)				310
TOTAL REQUEST				5,840
TOTAL REQUEST (ROUNDED)				5,840

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Construct a Utility Monitoring and Control System (UMCS) to monitor and control HVAC systems, and the utilities serving 190 buildings at Fort Riley. The UMCS will replace the existing HVAC control systems and energy monitoring and control system (EMCS). The UMCS would consist of PC-based front-end computers communicating to building control units. Other associated items include software, fiber optic data communication systems, instrumentation, documentation, training, and testing of equipment.

11. REQUIREMENT

This project is required to correct local HVAC control problems and deficiencies, in order that environmental cooling and heating are adequately provided for active duty personnel at Fort Riley. This project will replace the existing local loop HVAC controls system with a new UMCS. The UMCS will monitor and control the facilities' HVAC systems, and utilities. This project will reduce the natural gas consumption, electrical consumption, and electric demand of HVAC systems through UMCS control technology. An immediate utility savings would be recognized.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE DEC 1995
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Install Basewide Utility Monitoring Control System (UMCS)		5. PROJECT NUMBER

11. REQUIREMENT (continued)

The project will include the following items of work:

- The UMCS will include PC-based front-end computers communicating to building Control Units, to control and monitor HVAC systems.
- Existing automatic temperature control equipment will be removed and disposed of. Some end control device components will be reused in the new UMCS and will be checked and commissioned into operating condition.
- New Direct Digital Control (DDC) components will be installed, to provide the required sequences of operation, input/output functions, and monitoring functions, including necessary software, hardware, instrumentation, communications, training, and documentation.
- The field hardware in the 23 buildings on the existing EMCS will be replaced.

Modifications or repairs to the existing mechanical and electrical equipment would be provided to assure a complete, well operating control system.

Additionally, the project will result in a more functionally efficient system providing greater reliability and more accurate temperature control, and will yield significant savings in operating costs by a more accurate and precise operation of air handling units, boilers, chillers, and other equipment.

Current Situation:

Fort Riley has an existing EMCS connected to 23 buildings. The EMCS was installed in 1985. The EMCS has a central operator station that includes a TI 112 CPU with a 40 megabyte hard drive, a cartridge tape data storage, a color monitor, a TI terminal printer, two dot matrix printers, and telephone modems. The EMCS has three work stations each consisting of a monitor, a telephone modem, and a dot matrix printer located at three remote sites from the central operator station.

Discussions with the EMCS operators at Fort Riley regarding the existing EMCS indicated the system is currently used to its capacity, is energy inefficient, and is technologically obsolete (failing).

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE DEC 1995
3. INSTALLATION AND LOCATION Fort Riley, Kansas		
4. PROJECT TITLE Install Basewide Utility Monitoring Control System (UMCS)		5. PROJECT NUMBER

11. REQUIREMENT (continued)

Impact if Not Provided:

If this project is not funded, a reduction of 211,470 MBtu/yr (223,100,850 MJ/yr) cannot be achieved. The Army will not realize a $1,525,870 annual energy dollar savings with a 3.95 simple payback and a savings-to-investment ratio (SIR) of 2.3. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation:

Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (E M C Engineers, Inc.) in FY 95.

Verification of Savings:

The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the installation of the UMCS can be compared to the energy use for billing periods subsequent to the UMCS installation.

Amount of Energy Conserved:

The amount of energy conserved is estimated to be 211,470 MBtu per year (223,100,850 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for Installation of UMCS			FISCAL YEAR:	1995
ANALYSIS DATE:	12/13/95	ECONOMIC LIFE:	10	PREPARED BY:	A. Niemeyer

1. INVESTMENT: **Install Basewide UMCS with DDC Controls**

A.	CONSTRUCTION COST	=	$5,167,395	
B.	SIOH COST	(7.0% of 1A) =	$361,718	
C.	DESIGN COST	(6.0% of 1A) =	$310,044	
D.	TOTAL COST	(1A +1B +1C) =	$5,839,156	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$5,839,156

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	58,176	$703,926	8.78	$6,180,473	
B.	DIST	$0.00	0	$0	9.88	$0	
C.	NAT GAS	$4.12	153,296	$631,580	9.53	$6,018,953	
D.	COAL	$0.00	0	$0	8.95	$0	
E.	ELEC. DEMAND			$190,361	8.53	$1,623,780	
F.	TOTAL		211,472	$1,525,867		-------->	$13,823,206

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE COST	($116,206)	8.53	($991,237)
2	ANNUAL MANHOUR SAVINGS	$67,824	8.53	$578,539
3			8.53	$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST (-)	($48,382)		($412,698)

B. NON-RECURRING (+/-)

	ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a.		$0	1	0.971	$0
b.					$0
c.					$0
d.					$0
e.					$0
f.	TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = ($412,698)

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,477,485
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.95
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$13,410,508
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.30

ENGINEER'S OPINION OF PROBABLE COST

SHEET 1 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**INSTALLATION OF UMCS**											
2	UMCS SOFTWARE/DATABASE	LS	1		$0			$144,580		$0		$144,580
3	UMCS CENTRAL EQUIPMENT	LS	1		$99,180			$9,828		$0		$109,008
4	TRAINING	LS	1		$0			$73,110		$0		$73,110
5	DOCUMENTATION AND SUBMITTALS	LS	1		$0			$50,000		$0		$50,000
6	TESTING	LS	1		$0			$197,908		$0		$197,908
7	TOTAL FIELD HARDWARE	LS	1		$1,452,577			$968,385		$0		$2,420,962
8	FIBER OPTIC DTM	LS	1		$326,908			$217,939		$0		$544,847
9	ACM REMOVAL	LS	1		$2,708			$11,501		$1,359		$15,567
10	RF SYSTEM FOR REMOTE SITE MONITORING	LS	1		$36,500			$13,119		$0		$49,619
11	FO DTM & EQUIP FOR UTILITY MONITORING	LS	1		$7,942			$9,426		$0		$17,368
12	SALES TAX	%	0.0		$0							$0
13	**CONSTRUCTION SUBTOTAL**				$1,925,815			$1,695,795		$1,359		$3,622,969
14	OVERHEAD	%	15.0		$288,872			$254,369		$204		$543,445
15	SUBTOTAL				$2,214,688			$1,950,164		$1,562		$4,166,414
16	BOND	%	2.5		$55,367			$48,754		$39		$104,160
17	SUBTOTAL				$2,270,055			$1,998,918		$1,601		$4,270,574
18	PROFIT	%	10.0		$227,005			$199,892		$160		$427,057
19	SUBTOTAL				$2,497,060			$2,198,810		$1,761		$4,697,632
20	CONTINGENCY	%	10.0		$249,706			$219,881		$176		$469,763
21	**GRAND TOTAL**				$2,746,766			$2,418,691		$1,938		$5,167,395
22	**SIOH COST**	%	7.0									$361,718
23	**DESIGN COST**	%	6.0									$310,044
24	**CURRENT WORKING ESTIMATE**											$5,839,156
25												
26	**1ST YR MAINT COST (8% of Field Hardwr Mat. Cost)**	%	8.0		$116,206			$0		$0		$116,206

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 2 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**UMCS SOFTWARE**											
3	OPERATING SYSTEM	LS	0	$0.00	$0	$0.00	0.0	$0	$0.00	$0	$0.00	$0
4	APPLICATION SOFTWARE	LS	0	$0.00	$0	$0.00	0.0	$0	$0.00	$0	$0.00	$0
5	COMMAND SOFTWARE	LS	0	$0.00	$0	$0.00	0.0	$0	$0.00	$0	$0.00	$0
6	**LUMP SUM TOTAL**			$16,800.00	$0	$0.00	0.0	$0	$0.00	$0	$16,800.00	$0
7												
8	**UMCS DATABASE**											
9	DATABASE GENERATION	PTS	6,680	$0.00	$0	$24.00	0.8	$120,240	$0.00	$0	$18.00	$120,240
10	GRAPHIC DISPLAY GENERATION	DIAG	42	$0.00	$0	$24.00	5.0	$5,040	$0.00	$0	$120.00	$5,040
11	GRAPHIC DISPLAY DUPLICATION	EA	965	$0.00	$0	$24.00	0.8	$19,300	$0.00	$0	$20.00	$19,300
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26	**TOTAL THIS PAGE**				$0			$144,580		$0		$144,580

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 3 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**UMCS CENTRAL EQUIPMENT**											
3	CENTRAL OPERATOR STATION	EA	1	$8,400.00	$8,400	$22.00	12	$265	$0.00	$0	$8,665.00	$8,665
4	ALARM PRINTER	EA	1	$720.00	$720	$0.00	0.0	$0	$0.00	$0	$720.00	$720
5	LOGGING PRINTER (LASER)	EA	1	$2,244.00	$2,244	$0.00	0.0	$0	$0.00	$0	$2,244.00	$2,244
6	FIBER OPTIC MODEM	EA	22	$624.00	$13,728	$0.00	0.0	$0	$0.00	$0	$624.00	$13,728
7	TELEPHONE MODEM	EA	1	$360.00	$360	$22.00	4	$98	$0.00	$0	$457.62	$458
8	PORTABLE TEST SET	EA	1	$1,800.00	$1,800	$0.00	0.0	$0	$0.00	$0	$1,800.00	$1,800
9	INSTALLATION AND TESTING	LS	1	$0.00	$0	$22.00	358	$7,875	$0.00	$0	$7,875.00	$7,875
10												
11	REMOTE WORKSTATION NO. 1	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
12	REMOTE WORKSTATION NO. 2	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
13	REMOTE WORKSTATION NO. 3	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
14	REMOTE WORKSTATION NO. 4	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
15	REMOTE WORKSTATION NO. 5	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
16	REMOTE WORKSTATION NO. 6	EA	1	$11,988.00	$11,988	$22.00	12	$265.00	$0.00	$0	$12,253.00	$12,253
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26	**TOTAL THIS PAGE**				$99,180			$9,828		$0		$109,008

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 4 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**TRAINING**											
3	OPERATOR TRAINING 1	EA	1	$0.00	$0	$22.00	293	$6,450.00	$0.00	$0	$6,450.00	$6,450
4	OPERATOR TRAINING 2	EA	1	$0.00	$0	$22.00	288	$6,330.00	$0.00	$0	$6,330.00	$6,330
5	OPERATOR TRAINING 3	EA	1	$0.00	$0	$22.00	755	$16,610.00	$0.00	$0	$16,610.00	$16,610
6	OPERATOR TRAINING 4	EA	6	$0.00	$0	$132.00	30	$23,520.00	$0.00	$0	$3,920.00	$23,520
7	MAINTENANCE TRAINING	EA	1	$0.00	$0	$22.00	255	$5,600.00	$0.00	$0	$5,600.00	$5,600
8												
9	REVIEW SUBMITTALS	LS	1	$0.00	$0	$0.00	0	$14,600.00	$0.00	$0	$0.00	$14,600
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26	**TOTAL THIS PAGE**				$0			$73,110		$0		$73,110

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 5 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**DOCUMENTATION AND SUBMITTALS**											
3	DOCUMENTATION	LS	1	$0.00	$0	$75.00	667	$50,000	$0.00	$0	$50,000.00	$50,000
4												
5	**TESTING**											
6	FACTORY TEST	LS	1	$0.00	$0	$22.00	455	$10,000	$0.00	$0	$10,000.00	$10,000
7	PERF. VERIFICATION TEST	LS	1	$0.00	$0	$22.00	545	$12,000	$0.00	$0	$12,000.00	$12,000
8	ENDURANCE TEST	LS	1	$0.00	$0	$22.00	455	$10,000	$0.00	$0	$10,000.00	$10,000
9	OPPOSITE SEASON TEST	LS	1	$0.00	$0	$22.00	227	$5,000	$0.00	$0	$5,000.00	$5,000
10	CONTRACTOR FIELD TEST (DIGITAL)	PNT	2,922	$0.00	$0	$22.00	0.75	$48,213	$0.00	$0	$16.50	$48,213
11	CONTRACTOR FIELD TEST (ANALOG)	PNT	6,830	$0.00	$0	$22.00	0.75	$112,695	$0.00	$0	$16.50	$112,695
12	**TOTAL TESTING**				$0			$197,908				$197,908
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26	**TOTAL THIS PAGE**				$0			$247,908		$0		$247,908

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 6 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**FIELD HARDWARE**											
3	FIELD HARDWARE FOR BLDG SYST.	LS	1	$1,452,577	$1,452,577	$22.00	44,017	$968,385	$0.00	$0	$2,420,962	$2,420,962
4	(Includes cost for field panels)											
5												
6	**FIELD HARDWARE SUBTOTAL**				$1,452,577			$968,385				$2,420,962
7												
8	**FIBER OPTIC DTM**											
9	UNDERGROUND DTM CONDUIT	LS	1	$326,908	$326,908	$22.00	9,906	$217,939	$0.00	$0	$544,847.00	$544,847
10	(134,158 LF)											
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26	**TOTAL THIS PAGE**				$1,779,485			$1,186,324		$0		$2,965,809

PREPARED BY	APPROVED BY	TITLE OR ORGANIZATION	DATE
AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 7 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**ACM REMOVAL - GLOVEBAG METHOD**											
3	BUILDING 222	EA	5	$12.00	$60	$32.00	1.6	$256	$6.50	$33	$69.70	$349
4	BUILDING 610	EA	5	$12.00	$60	$32.00	1.6	$256	$6.50	$33	$69.70	$349
5	BUILDING 723	EA	7	$12.00	$84	$32.00	1.6	$358	$6.50	$46	$69.70	$488
6	BUILDING 5000	EA	4	$12.00	$48	$32.00	1.6	$205	$6.50	$26	$69.70	$279
7	BUILDING 5315	EA	7	$12.00	$84	$32.00	1.6	$358	$6.50	$46	$69.70	$488
8	BUILDING 7024	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
9	BUILDING 7033	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
10	BUILDING 7050	EA	2	$12.00	$24	$32.00	1.6	$102	$6.50	$13	$69.70	$139
11	BUILDING 7086	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
12	BUILDING 7243	EA	2	$12.00	$24	$32.00	1.6	$102	$6.50	$13	$69.70	$139
13	BUILDING 7285	EA	4	$12.00	$48	$32.00	1.6	$205	$6.50	$26	$69.70	$279
14	BUILDING 7602 (did not qualify)	EA	0	$12.00	$0	$32.00	1.6	$0	$6.50	$0	$69.70	$0
15	BUILDING 7606	EA	6	$12.00	$72	$32.00	1.6	$307	$6.50	$39	$69.70	$418
16	BUILDING 7608 (did not qualify)	EA	0	$12.00	$0	$32.00	1.6	$0	$6.50	$0	$69.70	$0
17	BUILDING 7612	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
18	BUILDING 7614	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
19	BUILDING 7616	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
20	BUILDING 7618	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
21	BUILDING 7620	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
22	BUILDING 7622	EA	5	$12.00	$60	$32.00	1.6	$256	$6.50	$33	$69.70	$349
23	BUILDING 7626	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
24	BUILDING 7630	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
25	BUILDING 7636	EA	4	$12.00	$48	$32.00	1.6	$205	$6.50	$26	$69.70	$279
26	**TOTAL THIS PAGE**				$1,212			$5,171		$657		$7,040

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AJN	DEJ	E M C Engineers, Inc.	12/13/95

ENGINEER'S OPINION OF PROBABLE COST

SHEET 8 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**ACM REMOVAL - GLOVEBAG METHOD (cont')**											
3	BUILDING 7642	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
4	BUILDING 7644	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
5	BUILDING 7648	EA	5	$12.00	$60	$32.00	1.6	$256	$6.50	$33	$69.70	$349
6	BUILDING 7652 (did not qualify)	EA	0	$12.00	$0	$32.00	1.6	$0	$6.50	$0	$69.70	$0
7	BUILDING 7654	EA	4	$12.00	$48	$32.00	1.6	$205	$6.50	$26	$69.70	$279
8	BUILDING 7658	EA	6	$12.00	$72	$32.00	1.6	$307	$6.50	$39	$69.70	$418
9	BUILDING 7739	EA	4	$12.00	$48	$32.00	1.6	$205	$6.50	$26	$69.70	$279
10	BUILDING 7804	EA	7	$12.00	$84	$32.00	1.6	$358	$6.50	$46	$69.70	$488
11	BUILDING 7810	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
12	BUILDING 7812	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
13	BUILDING 7816	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
14	BUILDING 7820	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
15	BUILDING 7826	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
16	BUILDING 7842	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
17	BUILDING 7844	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
18	BUILDING 7846	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
19	BUILDING 7850	EA	8	$12.00	$96	$32.00	1.6	$410	$6.50	$52	$69.70	$558
20	BUILDING 7856	EA	6	$12.00	$72	$32.00	1.6	$307	$6.50	$39	$69.70	$418
21	BUILDING 7858	EA	3	$12.00	$36	$32.00	1.6	$154	$6.50	$20	$69.70	$209
22	BUILDING 7865	EA	5	$12.00	$60	$32.00	1.6	$256	$6.50	$33	$69.70	$349
23												
24	MOBILIZATION COSTS	EA	1	$200.00	$200	$40.00	20.0	$800	$0.00	$0	$1,000.00	$1,000
25												
26	**TOTAL THIS PAGE**				$1,496			$6,330		$702		$8,528

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ENGINEER'S OPINION OF PROBABLE COST

SHEET 9 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**RADIO FREQUENCY SYSTEM FOR REMOTE SITE MONITORING**											
3	**CAMP FUNSTON**											
4	BUILDING 1470	EA	1	$4,635.00	$4,635	$22.00	79	$1,737	$0.00	$0	$6,372.00	$6,372
5	GAS METER NO. 3	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
6	GAS METER NO. 4	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
7												
8	**CAMP FORSYTH**											
9	ANZIO ELECTRIC SUBSTATION	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
10	GAS METER NO. 5	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
11	GAS METER NO. 11 (Colyer Apts.)	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
12												
13	**CUSTER HILL**											
14	GAS METER NO. 9	EA	1	$5,085.00	$5,085	$22.00	79	$1,737	$0.00	$0	$6,822.00	$6,822
15												
16	**CENTRAL STATION**											
17	RF SYSTEM CONNECTION	EA	1	$1,355.00	$1,355	$22.00	44	$960	$0.00	$0	$2,315.00	$2,315
18												
19												
20												
21												
22												
23												
24												
25												
26	**TOTAL THIS PAGE**				$36,500			$13,119		$0		$49,619

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ENGINEER'S OPINION OF PROBABLE COST

SHEET 10 OF 10

AREA	ACTIVITY	LOCATION	AMENDMENT NO.
		Ft. Riley, Kansas	

PROJECT TITLE	CONTRACT NO.
EEAP, Feasibility Study for Installation of UMCS	DACA01-94-D-0033

Line No.	Item Description	Unit of Meas.	No. of Units	MATERIAL COST		LABOR COST			EQUIPMENT COST		TOTAL COST	
				Unit Cost	Total	Unit Cost	Manhrs per Unit	Total	Unit Cost	Total	Unit Cost	Total
1	**ALTERNATIVE NO. 1**											
2	**FO DTM AND UMCS EQUIP FOR GAS METER MONITORING**											
3	**MAIN POST AREA - FO DTM**											
4	GAS METER NO. 1	LF	200	$2.44	$487	$22.00	0.09	$383	$0.00	$0	$4.35	$870
5	GAS METER NO. 2	LF	200	$2.44	$487	$22.00	0.09	$383	$0.00	$0	$4.35	$870
6	GAS METER NO. 6	LF	150	$2.29	$343	$22.00	0.07	$3,300	$0.00	$0	$3.83	$3,643
7	GAS METER NO. 8	LF	30	$2.88	$86	$22.00	0.09	$660	$0.00	$0	$4.79	$746
8	GAS METER NO. 10	LF	50	$2.88	$144	$22.00	0.09	$1,100	$0.00	$0	$4.79	$1,244
9	GAS METER NO. 12	LF	50	$2.88	$144	$22.00	0.09	$1,100	$0.00	$0	$4.79	$1,244
10												
11	**MAIN POST AREA - UMCS EQUIPMENT (ACUs and Connection to Utility)**											
12	GAS METER NO. 1	EA	0.5	$1,250.00	$625	$22.00	23	$250	$0.00	$0	$1,750.00	$875
13	GAS METER NO. 2	EA	0.5	$1,250.00	$625	$22.00	23	$250	$0.00	$0	$1,750.00	$875
14	GAS METER NO. 6	EA	1.0	$1,250.00	$1,250	$22.00	23	$500	$0.00	$0	$1,750.00	$1,750
15	GAS METER NO. 8	EA	1.0	$1,250.00	$1,250	$22.00	23	$500	$0.00	$0	$1,750.00	$1,750
16	GAS METER NO. 10	EA	1.0	$1,250.00	$1,250	$22.00	23	$500	$0.00	$0	$1,750.00	$1,750
17	GAS METER NO. 12	EA	1.0	$1,250.00	$1,250	$22.00	23	$500	$0.00	$0	$1,750.00	$1,750
18												
19												
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25												
26	**TOTAL THIS PAGE**				$7,942			$9,426		$0		$17,368

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